BMDS

BALLISTIC MISSILE DEFENSE SYSTEM

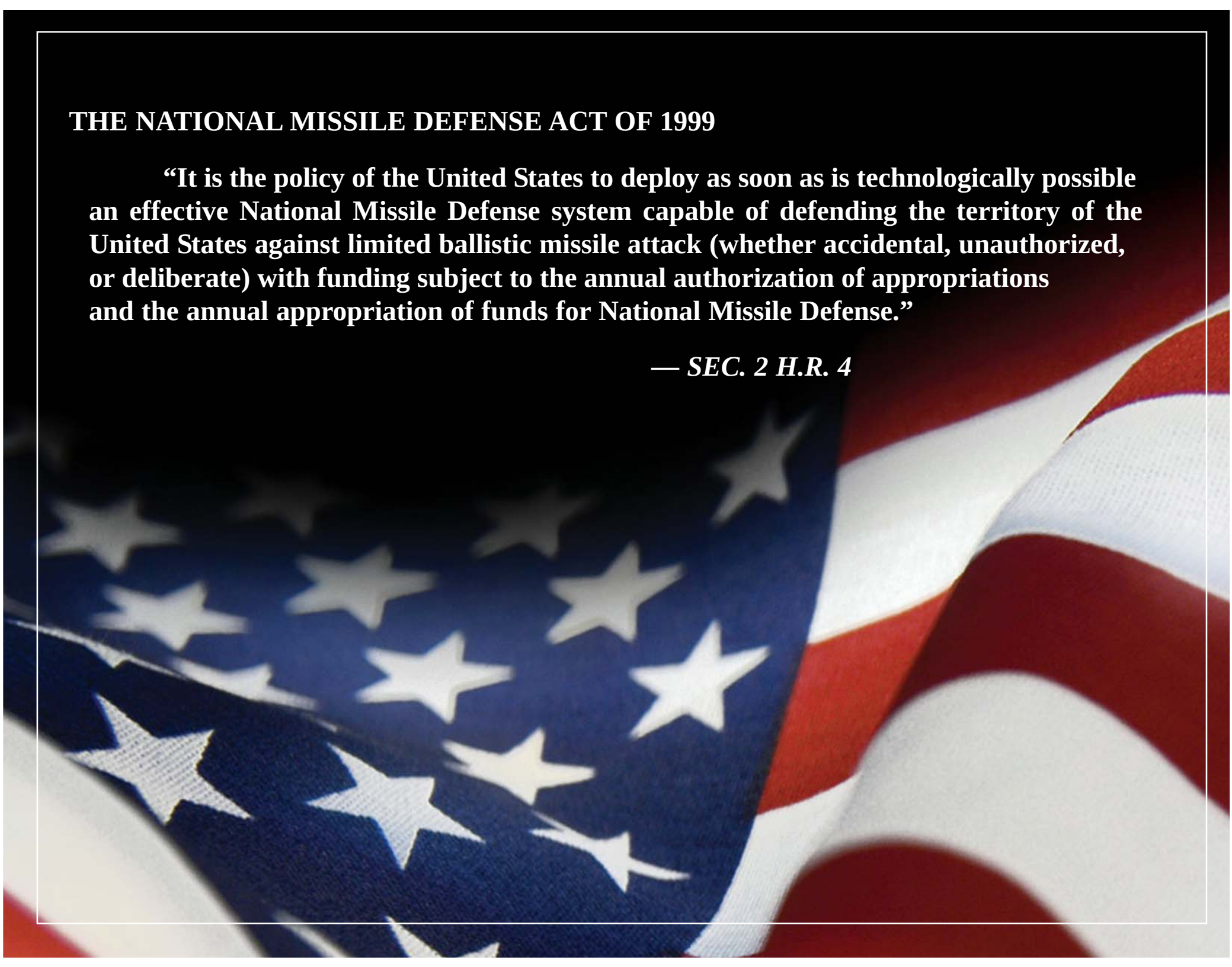
THE BEGINNING

MISSILE DEFENSE AGENCY
DEPARTMENT OF DEFENSE

THE NATIONAL MISSILE DEFENSE ACT OF 1999

"It is the policy of the United States to deploy as soon as is technologically possible an effective National Missile Defense system capable of defending the territory of the United States against limited ballistic missile attack (whether accidental, unauthorized, or deliberate) with funding subject to the annual authorization of appropriations and the annual appropriation of funds for National Missile Defense."

— SEC. 2 H.R. 4

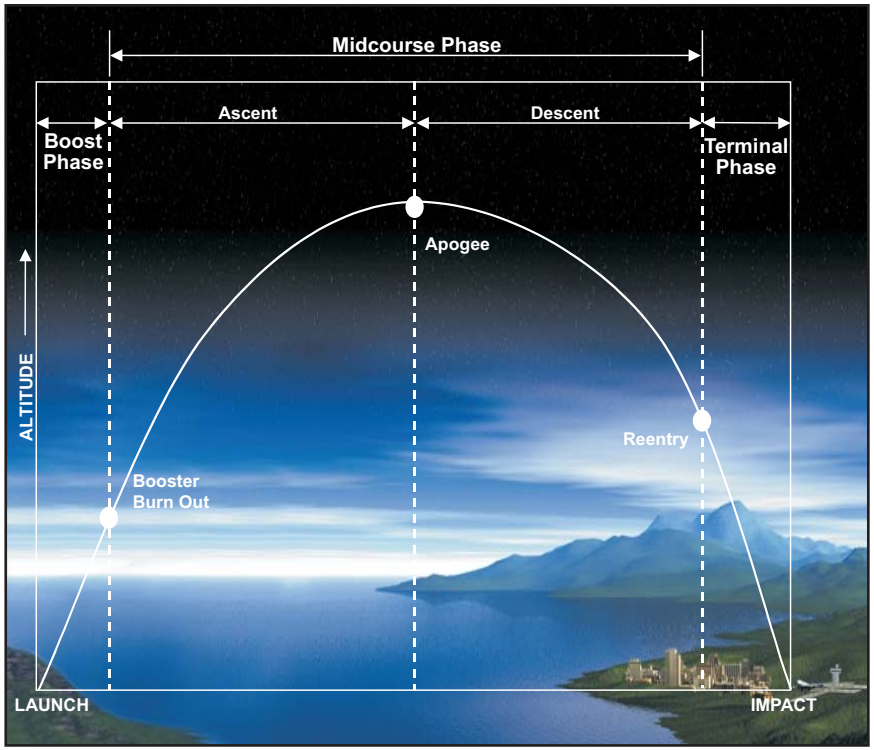


EXECUTIVE SUMMARY

The Challenge of Ballistic Missile Defense

Ballistic missile defense is one of the most challenging missions in the Department of Defense. A ballistic missile's altitude and speed leave little room for error. To meet this challenge, we attempt to destroy the ballistic missile in each of its three distinct phases of flight — boost, midcourse, and terminal.

In the boost phase, the ballistic missile's engine ignites and thrusts the missile into the atmosphere. This is the earliest point in the missile's flight path for an intercept. During the boost phase, the ballistic missile is easier to detect and track due to its bright, hot exhaust. However, the boost phase is very short and requires quick reaction and a means of destroying the missile.



Ballistic Missile Trajectory

Following the boost phase is the midcourse phase, in which the missile's booster burns out and the missile begins a ballistic trajectory based on its forward momentum and the force of gravity. The midcourse phase is generally the longest phase of a ballistic missile's flight path, approximately 20 minutes for a long-range missile. This phase offers the defender several opportunities to shoot down the ballistic missile. It is also in this phase that the missile may deploy a reentry vehicle (RV), the part of the missile that carries the weapon payload as well as potential countermeasures that try to mask or disguise the RV. A successful midcourse intercept is complicated since the RV will be surrounded by booster debris and potential countermeasures; therefore, an intercept in this phase requires a variety of sensors, including those onboard the interceptor, that are able to find the RV amid the booster debris and countermeasures. If an intercept is made in space or high enough in the atmosphere, it is likely that the lethal payload will burn up as it reenters the atmosphere.

The terminal phase of a ballistic missile's flight is the last opportunity for intercept prior to detonation or impact. As the missile proceeds to the intended target, the RV has separated from the debris field due to atmospheric drag. A successful terminal intercept requires an advanced interceptor capable of countering any maneuvers the RV may make as it closes in on its target.

All of these intercept scenarios — boost, midcourse, and terminal — require accurate missile tracking; quick reaction time; advanced interceptor missiles or directed energy (e.g., lasers); reliable communications; and advanced sensors.

EXECUTIVE SUMMARY

The Need for Missile Defense

The spread of ballistic missile technology has accelerated in recent years. The proliferation of missile technology is difficult to control, especially as more countries develop more sophisticated missile designs, including missiles capable of reaching the United States. Great danger also lies in the existence of chemical, biological, and nuclear weapons that can be paired with long-range ballistic missiles against the United States, our troops abroad, or our allies, and friends.

The Ballistic Missile Defense System

The worldwide proliferation of ballistic missiles combined with growing development of deadly nuclear, chemical, and biological agents requires the United States to field defensive missiles as soon as possible.

In response to this national security challenge, the Missile Defense Agency (MDA) is developing an integrated, layered Ballistic Missile Defense System (BMDS). Over time, the BMDS will become capable of handling all three phases of a hostile ballistic missile's flight, as well as defending against all ranges of ballistic missiles — short, medium, intermediate, and long.

The long-term BMDS will involve multiple sensors and interceptors that are integrated by a command control, battle management, and communications network. This network will enable the sharing of missile tracking data from any BMDS sensor to any other BMDS component. An integrated, layered BMDS will complicate our adversaries' efforts and reduce the military utility of ballistic missiles, discouraging the proliferation of such technology, as well as providing an effective deterrent.

With the Initial Defensive Capability (IDC) we are laying the foundation of the BMDS. The President has directed the Department of Defense to begin fielding an initial set of missile defense weapons, equipment, and software to provide a modest defense against the limited, near-term ballistic missile threat. This initial capability enables engagement of long-range ballistic missiles (LRBMs) and intermediate-range ballistic missiles (IRBMs) in the midcourse phase using Ground-Based Interceptors (GBIs). The IDC also provides a defense against short-range ballistic missiles (SRBMs) and medium-range ballistic missiles (MRBMs) using Patriot Advanced Capability-3 (PAC-3) missiles and Standard Missile-3 (SM-3) interceptors.

Our Acquisition Strategy

Because the ballistic missile threat changes quickly, the Department of Defense is using "capabilities-based" acquisition for the BMDS. This is a more flexible development process that responds quickly to a rapidly changing threat and takes advantage of advances in technology.

The BMDS program is structured in two-year "blocks," with fielding opportunities occurring throughout the blocks. The first period, Block 2004, represents calendar years 2004-2005. Block 2006 represents 2006-2007, and so on. The work done in each block will build upon the capabilities and development of previous blocks. The IDC is the beginning, and over time, this block approach will yield a fully integrated and layered BMDS, capable of defeating ballistic missiles of all ranges and in all phases of flights.

Initiating a Missile Defense Capability

BALLISTIC MISSILE DEFENSE SYSTEM

Introduction and Goals

To counter the threat of ballistic missiles carrying Weapons of Mass Destruction (WMD), the Department of Defense established the Missile Defense Agency (MDA) to manage and integrate all missile defense programs and technologies into one Ballistic Missile Defense System (BMDS). Our top Missile Defense priorities are:

- To defend the United States, deployed forces, allies, and friends
- To employ a BMDS that layers of defenses to intercept ballistic missiles in all phases of their flight — boost, midcourse, and terminal — against all ranges of threats — short, medium, intermediate, and long
- To enable early fielding for elements of the BMDS
- To develop and test technologies and, if necessary, use prototype and test assets to provide early capability

Ballistic Missile Defense System

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- Block 2004 Objective: Field an initial capability to provide a modest defense of the United States
- Block 2006 Objective: Increase the depth and breadth of our initial capability by adding interceptors, adding "deployable" radars, and integrating these systems to maximize their performance
- Block 2008 Objective: Enhance our ability to protect our deployed forces and coalition partners, and add an initial capability to defeat the threats in the boost phase

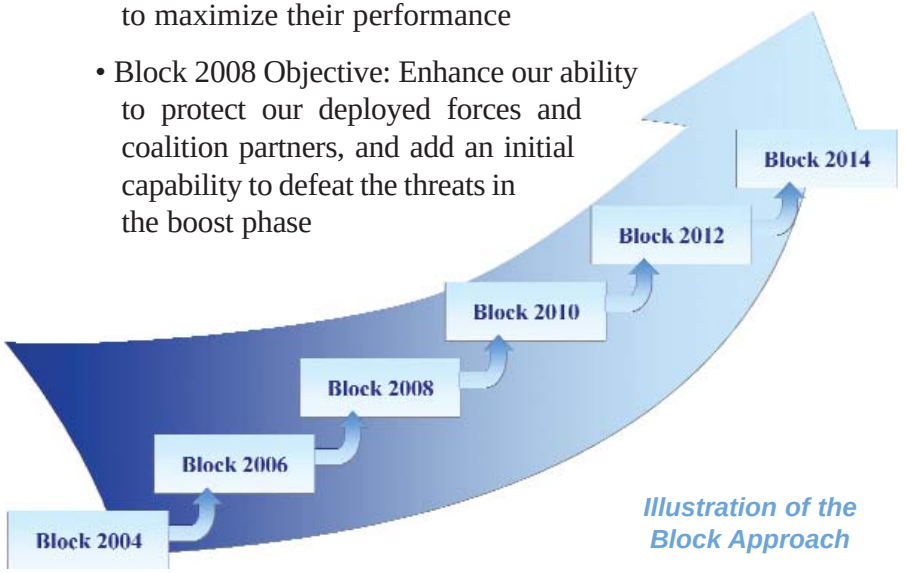


Illustration of the Block Approach

Engagement Sequences

MDA has developed an "engagement sequence" concept to demonstrate and measure how the components of the BMDS work together. An engagement sequence is a unique combination of detect-control-engage functions performed by BMDS components (e.g., sensors, weapons, and command control equipment) used to engage a threat ballistic missile. The engagement sequence defines the specific detection sensor, fire control radar, and weapon to be used, and is an innovative product of our efforts to create an integrated system, as opposed to a collection of diverse units.

MDA's testing program verifies the engagement sequences. These sequences, in turn, allow MDA to test the flexibility and interoperability of the system. Engagement sequence testing measures the effectiveness of data interchange between components, such as a sensor and the kill vehicle. A notional engagement sequence with the initial missile defense capability against a long-range ballistic missile is described below (see *Engagement Sequence* graphic on next page).

(1) The Defense Support Program constellation of satellites monitors the entire globe. These satellites use infrared sensors to detect the heat generated during a missile launch.

(2) The U.S. National Military Command and Control Network receives an alert of the possible launch of a long-range ballistic missile. The alert would be sent to several Department of Defense locations, including the Combatant Commands (COCOMS). Upon receiving the alert from the COCOMS, the BMDS directs its land- and sea-based sensors to search for the long-range missile flying along a predicted trajectory.

(3) Forward-deployed U.S. Navy Aegis destroyers receive the launch notification and, using the upgraded SPY-1 radar, begin searching possible trajectory sectors for a ballistic missile. Upon detection, the tracking information is transmitted through the BMDS Data Network to the Ground-Based Midcourse Defense (GMD) system. An intercept course is calculated based on such tracking data.

(4) A Ground-Based Interceptor (GBI) is launched.

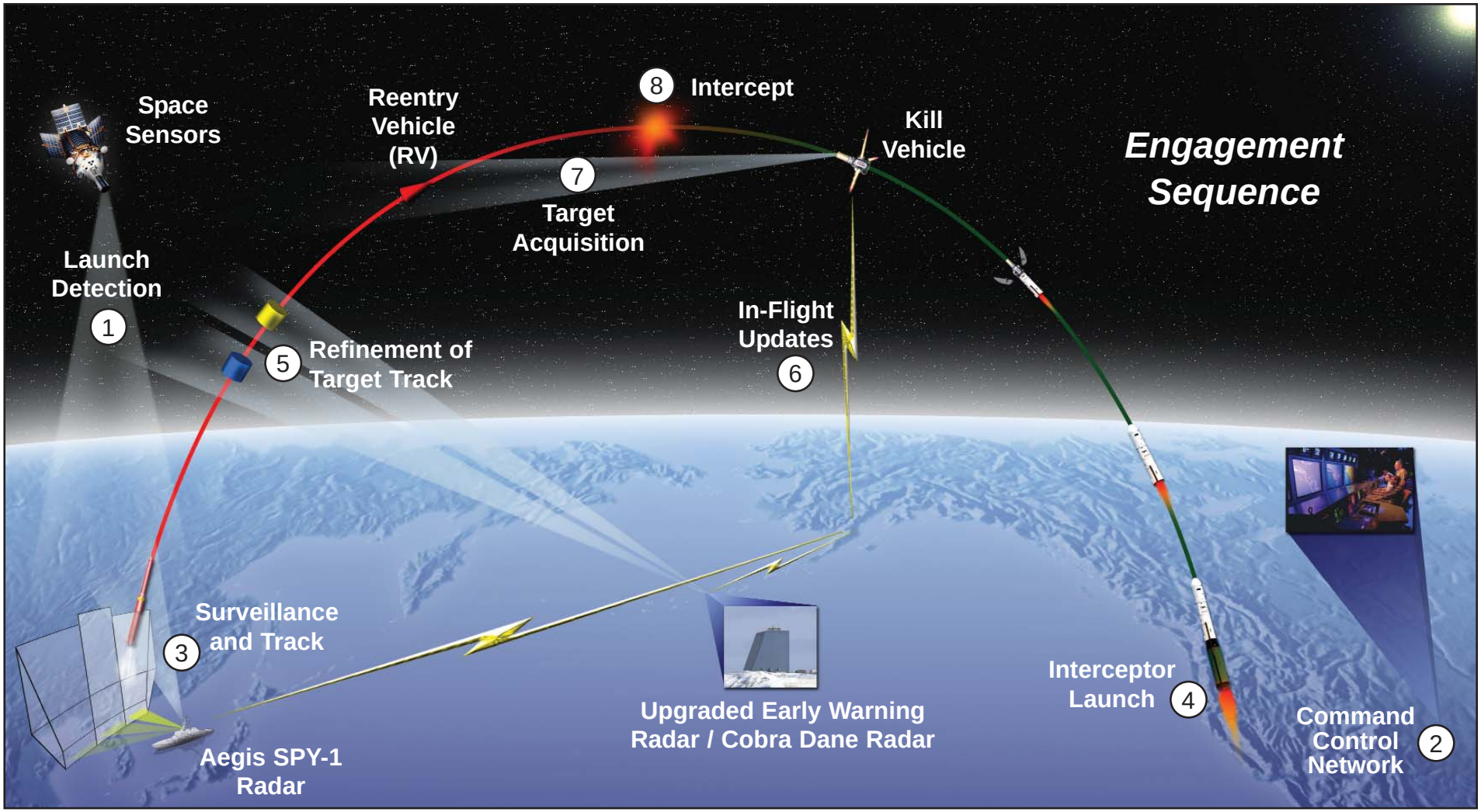
(5) The Upgraded Early Warning Radar (UEWR) is alerted as the hostile missile approaches the radar's area of coverage. Once the hostile missile has completed its boost phase, the booster separates and a reentry vehicle (RV) containing a weapon — chemical, biological, nuclear, or conventional — is deployed, possibly with countermeasures (e.g., decoys). Using improvements in track accuracy, the UEWR identifies and begins to track the cluster containing the RV.

(6) UEWR tracking data is used to provide interceptor course corrections. These corrections are transmitted to the interceptor missile so that it steers to the proper point in space where it releases its "kill vehicle."

(7) The kill vehicle, a 155-pound system of advanced sensors and state-of-the-art components, uses the information it has received from the command and control network to get into the proper position. Once there, the kill vehicle uses its onboard sensors to locate and acquire the target cluster and discriminate the RV from any accompanying decoys.

(8) The kill vehicle adjusts its trajectory using small rocket motors to collide with the RV payload at a closing speed of more than 15,000 miles per hour. The force of the impact pulverizes the RV using only the kinetic force of the collision. This is called "hit-to-kill" technology.

BALLISTIC MISSILE DEFENSE SYSTEM



How Missile Defense will Defend the United States

It could take less than 30 minutes for a long-range ballistic missile, launched from any location in the world, to impact a city or town in any of our 50 states. The initial fielding of the BMDS is not the perfect system, but it will provide a necessary missile defense capability where none exists today.

Future Engagement Sequences

Future upgrades to the BMDS will give us the ability to defeat all types of enemy ballistic missiles in all phases of their flight. In the future, the BMDS will have more interceptors and a larger number of sensors. With these changes, there will be additional engagement sequences.

Testing

Our BMDS testing philosophy recognizes the need for an integrated, phased test program that covers all facets of testing using flight tests, ground tests, wargames, and models and simulations. Employing this philosophy we continue to have success in our test program.

MDA will upgrade and improve the missile defense system and continue testing to ensure it can provide progressively better defense.

System Tests

MDA has developed a system test program for the characterization, verification, and assessment of each BMDS block. Testing will be conducted by the execution of several different system tests.

Each system test occurs in a series of sequential tests consisting of modeling and simulation; wargaming; and ground and flight tests. As these tests progress, BMDS functionality, fidelity, and operational realism increase, progressively building to a better capability.

Flight Tests

System-level flight tests are run to determine how well numerous technologies perform under controlled conditions so that the performance of thousands of components can be analyzed and catalogued to ensure everything works as designed. Flight tests also expose necessary improvements and upgrades that will make the system more effective and reliable. In past flight tests, targets were launched from Vandenberg Air Force Base in California, and interceptors were fired from Kwajalein Atoll in the Pacific Ocean. This scenario resulted in the same target trajectory and engagement area in each test. Realistic targets will now also be launched from the Kodiak Launch Complex in Alaska, with interceptors launched from Vandenberg. This new launch area will produce a new trajectory, enabling other BMDS sensors to participate in the engagement.

MDA has scheduled a series of flight tests involving more operational realism. In addition to the new target trajectory, operationally realistic targets will be used. These targets will test the kill vehicle's ability to use onboard sensors, as well as updates from BMDS sensors to identify the reentry vehicle among the accompanying booster debris and countermeasures.

Ground Tests

Ground testing entails an integrated test of the BMDS. Simulated target information is fed into the BMDS sensors, command control network, and weapons. The BMDS equipment and software respond accordingly. Potential problems are uncovered and results of virtual intercepts are recorded. Such ground testing allows numerous virtual scenarios to be run during one test period without

launching any live targets or interceptors. Each IDC component and engagement sequence will be verified and assessed by ground testing. Such testing is conducted prior to the appropriate flight tests.

Testing to Date

During fiscal years 2002 and 2003, MDA achieved three of four long-range, ground-based intercepts; four of five ship-based exoatmospheric intercepts; and four of five short-range, ground-based intercepts. A great deal is learned from each test even when an intercept is not achieved.

In fiscal years 2004 and 2005, MDA plans to conduct additional testing with increasing complexity. This extensive system testing is necessary to increase confidence in the technology, provide realistic training, and ensure the system works as designed. The initial fielding of the BMDS will greatly contribute to homeland defense and national security, but it is just the beginning. As upgrades and improvements are added, verification and testing of the BMDS will continue.

The Beginning

Presidential Direction

More than 30 nations have ballistic missiles in their arsenals, with hundreds of launchers. More than 25 nations have, or are developing, nuclear, chemical, and biological weapons. President George W. Bush directed the Department of Defense to begin fielding an initial set of missile defense capabilities to meet the near-term ballistic missile threat to our homeland, deployed forces, allies, and friends. To fulfill this direction, MDA plans to field an initial defense capability in 2004-2005. This first capability of the BMDS is also known as the Initial Defensive Capability (IDC).

> ***"Defending the American people against these new threats (ballistic missiles) is my highest priority as Commander-in-Chief, and the highest priority of my administration."***
>
> — President George W. Bush, December 17, 2002

Beginning in 2004, MDA will put the BMDS on alert, providing a capability that the United States does not now have — a capability to intercept and destroy a ballistic missile before it can strike any of our 50 states. Over the long term, MDA plans to increase the breadth and depth of our missile defense by adding forward-deployed, networked sensors, such as new radars; missile interceptors based at sea and on land; and layers of increasingly capable weapons and sensors. MDA's objectives for meeting these defense priorities are to complete, verify, and test the configuration and equipment for the IDC of the BMDS; put the BMDS on alert to protect our nation; and conduct concurrent testing and operations as the system is upgraded and improved to meet an evolving threat.

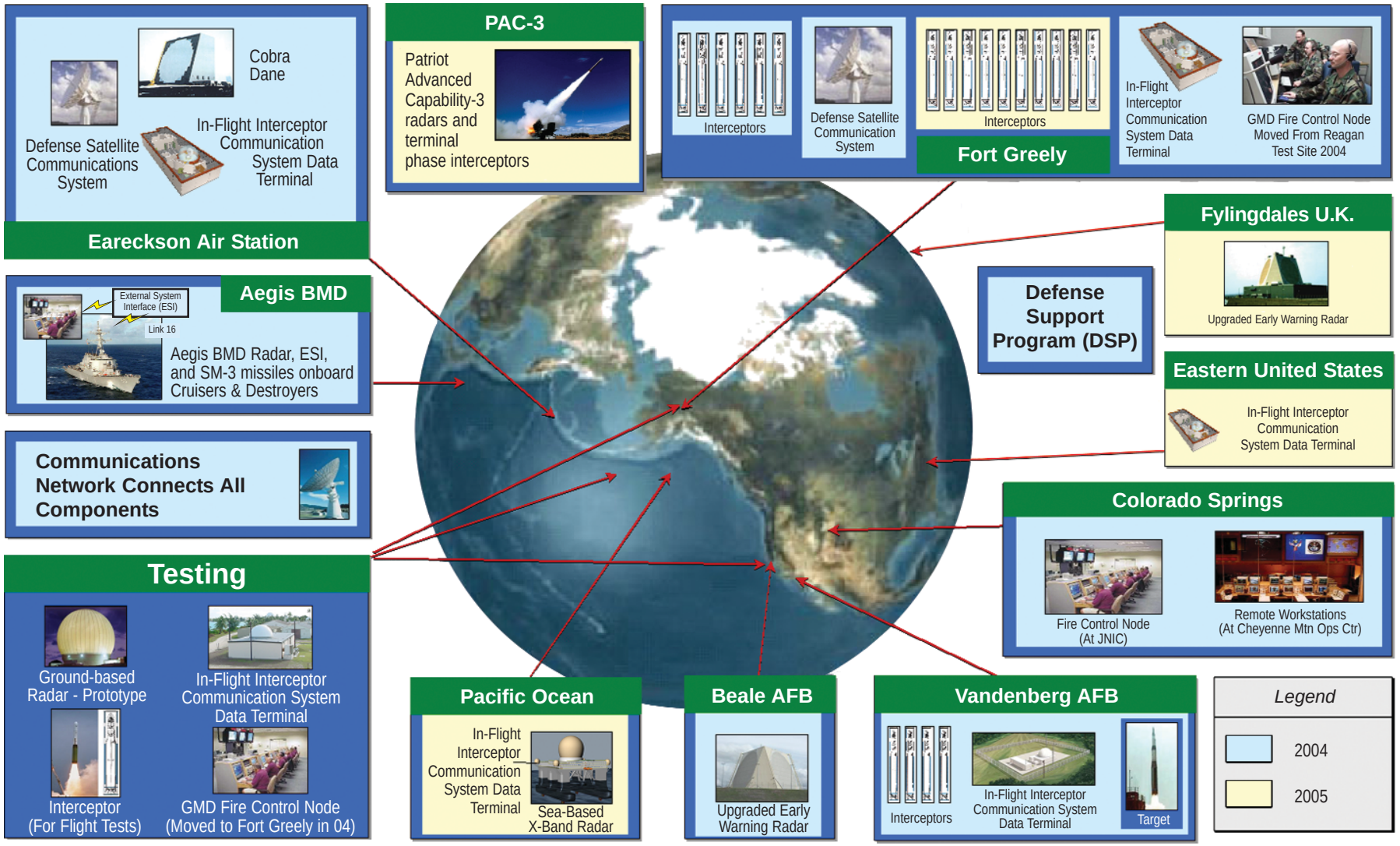
The IDC is the initial fielding of the BMDS and lays a foundation that over time will be improved to provide eventually an effective defense against missiles of all ranges, and during all three phases of flight — boost, midcourse, and terminal.

The fielding of BMDS components will take place at different times. Therefore, the activation of the BMDS will not happen all at once on a certain date. Rather, components will be put on alert as they become available.

Training and Operations

Joint military service commands, called Combatant Commands or COCOMS, are responsible for planning, manage-

THE BEGINNING



Components of the Initial Missile Defense Capability

Nighttime Missile Launch at Vandenberg Air Force Base

ment, and day-to-day operation of the fielded elements of the BMDS.

The BMDS will be manned by highly trained military personnel. Missile defense system operators will receive advanced training and certification in order to meet the strict standards required to operate and maintain the missile defense equipment. This training is a cooperative effort among MDA, COCOMS, and the Services.

Concurrent Testing and Operations

BMDS Test Bed

Since ballistic missiles (and interceptor missiles) are capable of traveling from hundreds to thousands of miles, a large test area, or test bed, is needed. The Department of Defense has an infrastructure for conducting missile tests in the Pacific Ocean, including Vandenberg Air Force Base, California, and existing radars in California, Hawaii, and the Republic of the Marshall Islands. However, realistic testing of the BMDS requires a larger test area with additional launch sites, as well as different radars and other sensors.

The existing radar on the Alaskan island of Shemya (in the Aleutian Island chain) will be used for initial operations, and the Sea-Based X-Band Radar (SBX) will be added in 2005 for increased capability to track hostile missile warheads and also participate in realistic testing.

Target missiles will be launched in some tests from an existing facility at Kodiak Island, also in Alaska. Additional test infrastructure will be available over time, possibly including the ability to launch target missiles from aircraft, which will allow MDA to test against a wide variety of missile trajectories or directions.

This additional test infrastructure will allow testing of weapons and sensors against ballistic missiles of all ranges, along different azimuths, and using different trajectories. When the BMDS Test Bed is complete, MDA will be able to execute multiple engagement opportunities — a true test of an integrated, layered defense.

Future Test Bed Additions

Future components will be added to the BMDS Test Bed over time. These may include:

- Boost phase engagements by the Airborne Laser (ABL) and Kinetic Energy Interceptor program
- Terminal High Altitude Area Defense (THAAD) engagements against short-, medium-, and intermediate-range ballistic missiles
- Sensor layering concepts using forward-deployed radars

Coordination Between COCOMS and MDA

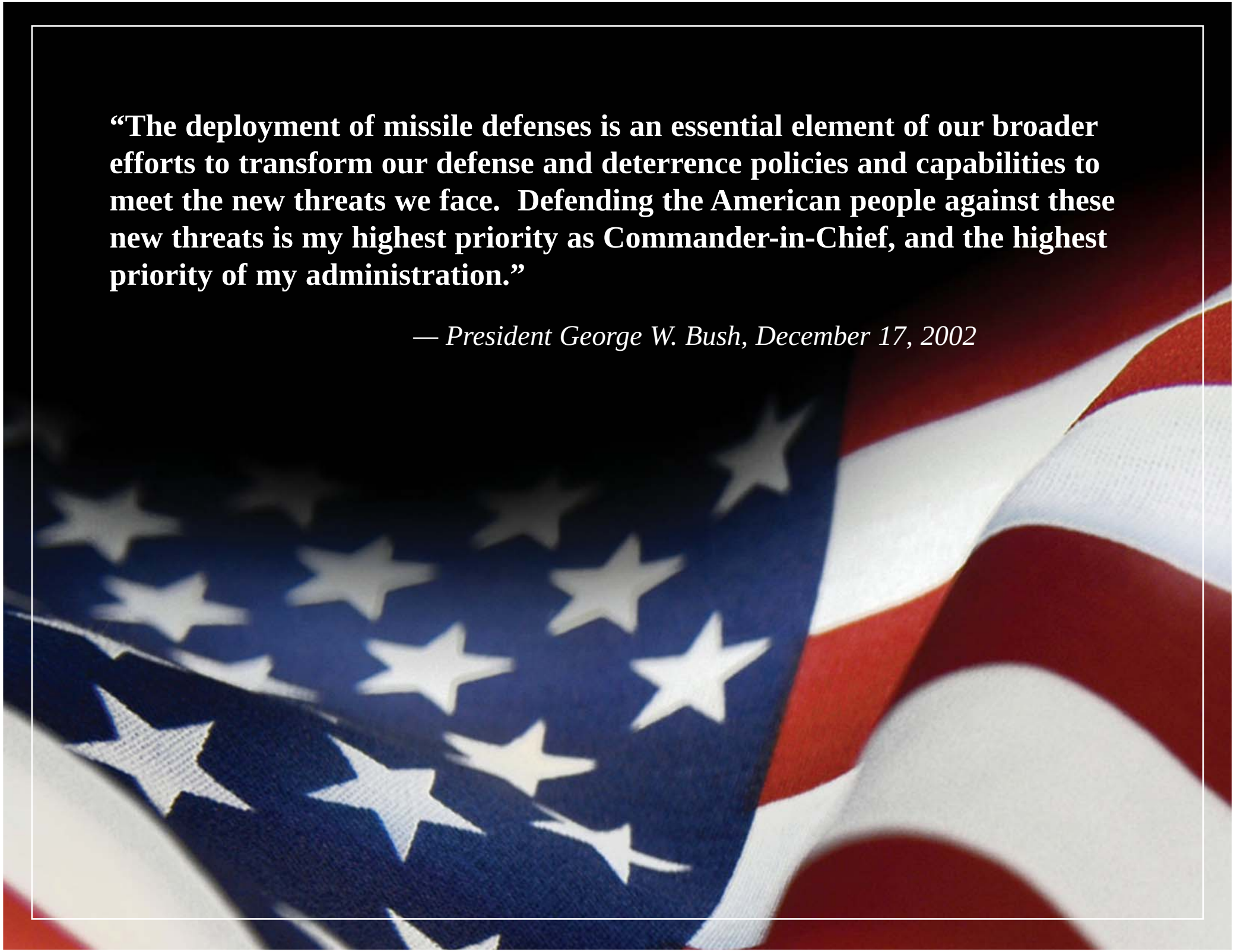
In order to maintain an effective operational missile defense capability while simultaneously conducting a vital test program, U.S. Strategic Command, U.S. Northern Command, U.S. Pacific Command, and MDA will cooperate closely in managing assets that support the fielded BMDS and testing.

Summary

MDA is laying the foundation of our nation's missile defenses with the initial fielding of the BMDS. This initial set of capabilities is designed to meet the near-term ballistic missile threat to our homeland, deployed forces, allies, and friends. Extensive realistic testing is planned to take place for many years. MDA's development program will provide improvements and upgrades to existing technology and will ensure that the missile defense system on alert is the most effective, reliable, and capable system, now and in the future, contributing greatly to homeland defense, public safety, and our overall national security.

For the first time, the BMDS will be able to execute multiple engagement opportunities, a true test of an integrated, layered defense. In the future, based on lessons learned in the BMDS Test Bed, more advanced capabilities will be fielded in successive blocks. The ABL and our Kinetic Energy Interceptor program would allow us to exploit the advantages of a boost-phase intercept. THAAD would add an additional intercept opportunity in the terminal phase and would provide a greater area of coverage than existing terminal point defenses. Forward-deployed radars would provide additional layers of sensor capability and more effective tracking of hostile missiles.

Over time, MDA's acquisition approach will yield a fully integrated and layered BMDS capable of defeating ballistic missiles of all ranges in all phases of flight.


“The deployment of missile defenses is an essential element of our broader efforts to transform our defense and deterrence policies and capabilities to meet the new threats we face. Defending the American people against these new threats is my highest priority as Commander-in-Chief, and the highest priority of my administration.”
— President George W. Bush, December 17, 2002


MISSILE DEFENSE AGENCY
DEPARTMENT OF DEFENSE